IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Withdrawn) A method for forming a differential GMR sensor, comprising:

forming a first shield and first gap layer;

forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer;

forming a bias structure over the first free layer, wherein the bias structure is formed to provide antiparallel magnetizations for the first and second free layers without using an antiferromagnetic layer; and

forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer.

2. (Withdrawn) The method of claim 1, wherein the forming the bias structure further comprises forming four ferromagnetic layers separated with three interlayers selected to provide a desired gap length.

3. (Withdrawn) The method of claim 1, wherein the forming the bias structure further comprises forming four ferromagnetic layers separated with three interlayers.

4. (Withdrawn) The method of claim 3, wherein the forming four ferromagnetic layers further comprises forming four NiFe layers.

5. (Withdrawn) The method of claim 4, wherein the forming four NiFe layers further comprises forming four NiFe layers having a nickel composition of 90%.

6. (Withdrawn) The method of claim 3, wherein the forming four ferromagnetic layers separated with three interlayers further comprises forming three interlayer comprises ruthenium.

7. (Withdrawn) The method of claim 1, wherein the forming the bias structure further comprises forming the bias structure with a layer of tantalum, a layer of aluminum oxide, a layer of nickel-iron-chromium and a layer of oxine copper.

8. (Withdrawn) The method of claim 7, wherein the forming the layer of aluminum oxide further comprises a layer of aluminum oxide having a thickness selected to minimize current shunting.

9. (Withdrawn) The method of claim 1, wherein the forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer and forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer further comprises forming the first and second free layer using a first free sublayer, an interlayer and a second free sublayer.

10. (Withdrawn) The method of claim 9, wherein the forming the first and second free layer further comprises biasing the first and second free layer 180° out of phase.

11. (Withdrawn) The method of claim 10, wherein the biasing the first and second free layer 180° out of phase further comprises using in-phase pinned layers.

12. (Withdrawn) The method of claim 1, wherein the forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer and forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer further comprises forming self-pinned pinned layers.

13. (Withdrawn) The method of claim 1, wherein the forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer and forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer further comprises forming the first and second pinned layers with antiparallel magnetizations to provide a net magnetostatic bias of zero for the first and for the second pinned layers.

14. (Withdrawn) The method of claim 1, wherein the forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer and forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer further comprises forming the first pinned layer using three ferromagnetic layers..

15. (Withdrawn) The method of claim 1, wherein the forming a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer and forming a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer further comprises forming a bottom pinned layer using a first top ferromagnetic layer, a first spacer and a first bottom ferromagnetic layer and forming a top pinned layer using a second top ferromagnetic layer, a second spacer and a second bottom magnetic layer.

16. (Withdrawn) The method of claim 15, wherein the forming the first bottom ferromagnetic layer and the second top ferromagnetic layer are formed using a high field reset.

17. (Withdrawn) The method of claim 15, wherein the forming the first top ferromagnetic layer and the second bottom ferromagnetic layer are formed having a magnetization 180° out of phase.

18. (Previously Presented) A differential GMR sensor, comprising:

a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer;

a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer; and

a bias structure disposed between the first free layer of the first self-pinned GMR sensor and the second free layer of the second self-pinned GMR sensor, wherein the bias structure is configured to provide antiparallel magnetizations for the first and second free layers without using an antiferromagnetic layer.

19. (Previously Presented) The sensor of claim 18, wherein the bias structure further comprises four ferromagnetic layers separated with three interlayers selected to provide a desired gap length.

20. (Original) The sensor of claim 18, wherein the bias structure further comprises four ferromagnetic layers separated with three interlayers.

21. (Previously Presented) The sensor of claim 20, wherein the four ferromagnetic layers further comprise four NiFe layers.

22. (Currently Amended) The sensor of claim 21, wherein the four NiFe layers comprise a nickel composition of 90%.

23. (Previously Presented) The sensor of claim 20, wherein the three interlayers further comprise ruthenium.

24. (Withdrawn) The sensor of claim 18, wherein the bias structure further comprises a layer of tantalum, a layer of aluminum oxide, a layer of nickel-iron-chromium and a layer of oxine copper.

25. (Withdrawn) The sensor of claim 24, wherein the layer of aluminum oxide further comprises a thickness selected to minimize current shunting.

26. (Withdrawn) The sensor of claim 18, wherein the first and second free layer each further comprises a first free sublayer, an interlayer and a second free sublayer.

27. (Withdrawn) The sensor of claim 26, wherein the first and second free layer are biased 180° out of phase.

28. (Withdrawn) The sensor of claim 27, wherein the first and second free layer are biased 180° out of phase using in-phase pinned layers.

29. (Withdrawn) The sensor of claim 18, wherein the first pinned layer and second pinned layer further comprises self-pinned pinned layers.

30. (Withdrawn) The sensor of claim 18, wherein the first and second pinned layers further comprises antiparallel magnetizations for providing a net magnetostatic bias of zero for the first and for the second pinned layers.

31. (Withdrawn) The sensor of claim 18, wherein the first pinned layer further comprises three ferromagnetic layers.

32. (Withdrawn) The sensor of claim 18, wherein the first pinned layer comprises a bottom pinned layer having a first top ferromagnetic layer, a first spacer and a first bottom ferromagnetic layer and the second pinned layer comprises a top pinned layer having a second top ferromagnetic layer, a second spacer and a second bottom magnetic layer.

33. (Withdrawn) The sensor of claim 32, wherein the first top ferromagnetic layer and the second bottom ferromagnetic layer have a magnetization 180° out of phase.

34. (Previously Presented) A magnetic disk recording system, comprising:

a magnetic storage medium having a plurality of tracks for recording of data; and

a magnetic transducer maintained in a closely spaced position relative to the magnetic storage medium during relative motion between the magnetic transducer and the magnetic storage medium, the magnetic transducer including a magnetoresistive read sensor, the magnetoresistive read sensor further comprising:

a first self-pinned GMR sensor having a first pinned layer, a first spacer layer and a first free layer;

a second self-pinned GMR sensor having a second pinned layer, a second spacer layer and a second free layer; and

a bias structure disposed between the first free layer of the first self-pinned GMR sensor and the second free layer of the second self-pinned GMR sensor, wherein the bias structure is configured to provide antiparallel magnetizations for the first and second free layers without using an antiferromagnetic layer.

35. (Previously Presented) The magnetic disk recording system of claim 34, wherein the bias structure further comprises four ferromagnetic layers separated with three interlayers selected to provide a desired gap length.

36. (Original) The magnetic disk recording system of claim 34, wherein the bias structure further comprises four ferromagnetic layers separated with three interlayers.

37. (Previously Presented) The magnetic disk recording system of claim 36, wherein the four ferromagnetic layers further comprise four NiFe layers.

38. (Currently Amended) The magnetic disk recording system of claim 37, wherein the four NiFe layers comprise a nickel composition of 90%.

39. (Previously Presented) The magnetic disk recording system of claim 36, wherein the three interlayers further comprise ruthenium.

40. (Withdrawn) The magnetic disk recording system of claim 34, wherein the bias structure further comprises a layer of tantalum, a layer of aluminum oxide, a layer of nickel-iron-chromium and a layer of oxine copper.

41. (Withdrawn) The magnetic disk recording system of claim 40, wherein the layer of aluminum oxide further comprises a thickness selected to minimize current shunting.

42. (Withdrawn) The magnetic disk recording system of claim 34, wherein the first and second free layer each further comprises a first free sublayer, an interlayer and a second free sublayer.

43. (Withdrawn) The magnetic disk recording system of claim 42, wherein the first and second free layer are biased 180° out of phase.

44. (Withdrawn) The magnetic disk recording system of claim 43, wherein the first and second free layer are biased 180° out of phase using in-phase pinned layers.

45. (Withdrawn) The magnetic disk recording system of claim 34, wherein the first pinned layer and second pinned layer further comprises self-pinned pinned layers.

46. (Withdrawn) The magnetic disk recording system of claim 34, wherein the first and second pinned layers further comprises antiparallel magnetizations for providing a net magnetostatic bias of zero for the first and for the second pinned layers.

47. (Withdrawn) The magnetic disk recording system of claim 34, wherein the first pinned layer further comprises three ferromagnetic layers.

48. (Withdrawn) The magnetic disk recording system of claim 34, wherein the first pinned layer comprises a bottom pinned layer having a first top ferromagnetic layer, a first spacer and a first bottom ferromagnetic layer and the second pinned layer comprises a top pinned layer having a second top ferromagnetic layer, a second spacer and a second bottom magnetic layer.

49. (Withdrawn) The magnetic disk recording system of claim 48, wherein the first top ferromagnetic layer and the second bottom ferromagnetic layer have a magnetization 180° out of phase.

50. (Currently Amended) A differential GMR sensor, comprising:

first self-pinned means having a first pinned layer, a first spacer layer and a first free layer;

second self-pinned means having a second pinned layer, a second spacer layer and a second free layer; and

means, disposed between the first free layer of the first self-pinned means and the second free layer of the second self-pinned means, for biasing the first and second free layers of the first and second self-pinned means to provide antiparallel magnetizations for the first and second free layers without using an antiferromagnetic layer.